



SUBSTITUTE SEQUENCE LISTING

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<120> THERMAL TOLERANT CELLULASE FROM ACIDOTHERMUS CELLULOLYTICUS

<130> NREL 01-37

<140> US 09/917,383

<141> 2001-07-28

<160> 14

<170> PatentIn version 3.2

<210> 1

<211> 1228

<212> PRT

<213> Acidothermus cellulolyticus

<220>

<221> misc\_feature

<223> GuxA full-length protein sequence

<400> 1

Met Glu Arg Thr Gln Gln Ser Gly Arg Asn Cys Arg Tyr Gln Arg Gly  
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Thr Thr Arg Met Pro Ala Ile Ser Lys Arg Leu Arg Ala Gly Val Leu  
20 25 30

Ala Gly Ala Val Ser Ile Ala Ala Ser Ile Val Pro Leu Ala Met Gln  
35 40 45

His Pro Ala Ile Ala Ala Thr His Val Asp Asn Pro Tyr Ala Gly Ala  
50 55 60

Thr Phe Phe Val Asn Pro Tyr Trp Ala Gln Glu Val Gln Ser Glu Ala  
65 70 75 80

Ala Asn Gln Thr Asn Ala Thr Leu Ala Ala Lys Met Arg Val Val Ser  
85 90 95

Thr Tyr Ser Thr Ala Val Trp Met Asp Arg Ile Ala Ala Ile Asn Gly  
100 105 110

Val Asn Gly Gly Pro Gly Leu Thr Thr Tyr Leu Asp Ala Ala Leu Ser  
115 120 125

Gln Gln Gln Gly Thr Thr Pro Glu Val Ile Glu Ile Val Ile Tyr Asp  
130 135 140

Leu Pro Gly Arg Asp Cys Ala Ala Leu Ala Ser Asn Gly Glu Leu Pro  
145 150 155 160

Ala Thr Ala Ala Gly Leu Gln Thr Tyr Glu Thr Gln Tyr Ile Asp Pro  
165 170 175

Ile Ala Ser Ile Leu Ser Asn Pro Lys Tyr Ser Ser Leu Arg Ile Val  
180 185 190

Thr Ile Ile Glu Pro Asp Ser Leu Pro Asn Ala Val Thr Asn Met Ser  
195 200 205

Ile Gln Ala Cys Ala Thr Ala Val Pro Tyr Tyr Glu Gln Gly Ile Glu  
210 215 220

Tyr Ala Leu Thr Lys Leu His Ala Ile Pro Asn Val Tyr Ile Tyr Met  
225 230 235 240

Asp Ala Ala His Ser Gly Trp Leu Gly Trp Pro Asn Asn Ala Ser Gly  
245 250 255

Tyr Val Gln Glu Val Gln Lys Val Leu Asn Ala Ser Ile Gly Val Asn  
260 265 270

Gly Ile Asp Gly Phe Val Thr Asn Thr Ala Asn Tyr Thr Pro Leu Lys  
275 280 285

Glu Pro Phe Met Thr Ala Thr Gln Gln Val Gly Gly Gln Pro Val Glu  
290 295 300

Ser Ala Asn Phe Tyr Gln Trp Asn Pro Asp Ile Asp Glu Ala Asp Tyr  
305 310 315 320

Ala Val Asp Leu Tyr Ser Arg Leu Val Ala Ala Gly Phe Pro Ser Ser  
325 330 335

Ile Gly Met Leu Ile Asp Thr Leu Arg Asn Gly Trp Gly Gly Pro Asn  
340 345 350

Glu Pro Thr Gly Pro Ser Thr Ala Thr Asp Val Asn Thr Phe Val Asn  
355 360 365

Gln Ser Lys Ile Asp Leu Arg Gln His Arg Gly Leu Trp Cys Asn Gln  
370 375 380

Asn Gly Ala Gly Leu Gly Gln Pro Pro Gln Ala Ser Pro Thr Asp Phe  
385 390 395 400

Pro Asn Ala His Leu Asp Ala Tyr Val Trp Ile Lys Pro Pro Gly Glu  
405 410 415

Ser Asp Gly Thr Ser Ala Ala Ser Asp Pro Thr Thr Gly Lys Lys Ser  
420 425 430

Asp Pro Met Cys Asp Pro Thr Tyr Thr Ser Tyr Gly Val Leu Thr  
435 440 445

Asn Ala Leu Pro Asn Ser Pro Ile Ala Gly Gln Trp Phe Pro Ala Gln  
450 455 460

Phe Asp Gln Leu Val Ala Asn Ala Arg Pro Ala Val Pro Thr Ser Thr  
465 470 475 480

Ser Ser Ser Pro Pro Pro Pro Pro Ser Pro Ser Ala Ser Pro Ser  
485 490 495

Pro Ser Pro Ser Pro Ser Pro Ser Ser Ser Pro Ser Pro Ser Pro Ser  
500 505 510

Pro Ser Ser Ser Pro Ser Pro Ser Pro Ser Pro Ser Pro Ser Pro Ser  
515 520 525

Ser Ser Pro Ser Pro Ser Pro Ser Ser Ser Pro Ser Pro Ser Pro Ser  
530 535 540

Pro Ser Pro Ser Pro Ser Ser Ser Pro Ser Pro Ser Pro Ser Ser Ser  
545 550 555 560

Pro Ser Pro Ser Pro Ser Pro Ser Pro Ser Pro Ser Ser Ser Pro Ser  
565 570 575

Pro Ser Pro Thr Ser Ser Pro Val Ser Gly Gly Leu Lys Val Gln Tyr  
580 585 590

Lys Asn Asn Asp Ser Ala Pro Gly Asp Asn Gln Ile Lys Pro Gly Leu  
595 600 605

Gln Leu Val Asn Thr Gly Ser Ser Val Asp Leu Ser Thr Val Thr  
610 615 620

Val Arg Tyr Trp Phe Thr Arg Asp Gly Gly Ser Ser Thr Leu Val Tyr  
625 630 635 640

Asn Cys Asp Trp Ala Ala Met Gly Cys Gly Asn Ile Arg Ala Ser Phe  
645 650 655

Gly Ser Val Asn Pro Ala Thr Pro Thr Ala Asp Thr Tyr Leu Gln Leu  
660 665 670

Ser Phe Thr Gly Gly Thr Leu Ala Ala Gly Gly Ser Thr Gly Glu Ile  
675 680 685

Gln Asn Arg Val Asn Lys Ser Asp Trp Ser Asn Phe Thr Glu Thr Asn  
690 695 700

Asp Tyr Ser Tyr Gly Thr Asn Thr Thr Phe Gln Asp Trp Thr Lys Val  
705 710 715 720

Thr Val Tyr Val Asn Gly Val Leu Val Trp Gly Thr Glu Pro Ser Gly  
725 730 735

Thr Ser Pro Ser Pro Thr Pro Ser Pro Ser Pro Ser Pro Ser  
740 745 750

Pro Gly Gly Asp Val Thr Pro Pro Ser Val Pro Thr Gly Leu Val Val  
755 760 765

Thr Gly Val Ser Gly Ser Ser Val Ser Leu Ala Trp Asn Ala Ser Thr  
770 775 780

Asp Asn Val Gly Val Ala His Tyr Asn Val Tyr Arg Asn Gly Val Leu

785

790

795

800

Val Gly Gln Pro Thr Val Thr Ser Phe Thr Asp Thr Gly Leu Ala Ala  
805 810 815

Gly Thr Ala Tyr Thr Tyr Thr Val Ala Ala Val Asp Ala Ala Gly Asn  
820 825 830

Thr Ser Ala Pro Ser Thr Pro Val Thr Ala Thr Thr Ser Pro Ser  
835 840 845

Pro Ser Pro Thr Pro Thr Gly Thr Thr Val Thr Asp Cys Thr Pro Gly  
850 855 860

Pro Asn Gln Asn Gly Val Thr Ser Val Gln Gly Asp Glu Tyr Arg Val  
865 870 875 880

Gln Thr Asn Glu Trp Asn Ser Ser Ala Gln Gln Cys Leu Thr Ile Asn  
885 890 895

Thr Ala Thr Gly Ala Trp Thr Val Ser Thr Ala Asn Phe Ser Gly Gly  
900 905 910

Thr Gly Gly Ala Pro Ala Thr Tyr Pro Ser Ile Tyr Lys Gly Cys His  
915 920 925

Trp Gly Asn Cys Thr Thr Lys Asn Val Gly Met Pro Ile Gln Ile Ser  
930 935 940

Gln Ile Gly Ser Ala Val Thr Ser Trp Ser Thr Thr Gln Val Ser Ser  
945 950 955 960

Gly Ala Tyr Asp Val Ala Tyr Asp Ile Trp Thr Asn Ser Thr Pro Thr  
965 970 975

Thr Thr Gly Gln Pro Asn Gly Thr Glu Ile Met Ile Trp Leu Asn Ser  
980 985 990

Arg Gly Gly Val Gln Pro Phe Gly Ser Gln Thr Ala Thr Gly Val Thr  
995 1000 1005

Val Ala Gly His Thr Trp Asn Val Trp Gln Gly Gln Gln Thr Ser  
1010 1015 1020

Trp Lys Ile Ile Ser Tyr Val Leu Thr Pro Gly Ala Thr Ser Ile  
1025 1030 1035

Ser Asn Leu Asp Leu Lys Ala Ile Phe Ala Asp Ala Ala Ala Arg  
1040 1045 1050

Gly Ser Leu Asn Thr Ser Asp Tyr Leu Leu Asp Val Glu Ala Gly  
1055 1060 1065

Phe Glu Ile Trp Gln Gly Gly Gln Gly Leu Gly Ser Asn Ser Phe  
1070 1075 1080

Ser Val Ser Val Thr Ser Gly Thr Ser Ser Pro Thr Pro Ser Pro  
1085 1090 1095

Ser Pro Thr Pro Thr Pro Ser Pro Thr Pro Thr Pro Ser Pro Ser  
1100 1105 1110

Pro Thr Pro Ser Pro Ser Pro Thr Ser Ser Pro Ser Ser Ser Gly  
1115 1120 1125

Val Ala Cys Arg Ala Thr Tyr Val Val Asn Ser Asp Trp Gly Ser  
1130 1135 1140

Gly Phe Thr Ala Thr Val Thr Val Thr Asn Thr Gly Ser Arg Ala  
1145 1150 1155

Thr Asn Gly Trp Thr Val Ala Trp Ser Phe Gly Gly Asn Gln Thr  
1160 1165 1170

Val Thr Asn Tyr Trp Asn Thr Ala Leu Thr Gln Ser Gly Ala Ser  
1175 1180 1185

Val Thr Ala Thr Asn Leu Ser Tyr Asn Asn Val Ile Gln Pro Gly  
1190 1195 1200

Gln Ser Thr Thr Phe Gly Phe Asn Gly Ser Tyr Ser Gly Thr Asn  
1205 1210 1215

Ala Ala Pro Thr Leu Ser Cys Thr Ala Ser  
1220 1225

<210> 2  
<211> 3687  
<212> DNA  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> GuxA full-length coding sequence

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tccatcgtgc cgctggcgat gcagcatcct gccatcgccg cgacgcacgt cgacaatccc 180  
tatgcgggag cgaccttctt cgtcaacccg tactgggcgc aagaagtaca gagcgaagcg 240  
gcgaaccaga ccaatgccac tctcgagcg aaaatgcgcg tcgtttccac atattcgacg 300  
gccgtctgga tggaccgcatt cgctgcgatc aacggcgtca acggcggacc cggcttgacg 360  
acatatctgg acgcccgcct ctcccgacag caggaaacca cccctgaagt cattgagatt 420  
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gctacggcag caggtttgca gacctatgaa acgcagtaca tcgatccgat tgcgagtatc 540  
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caaggcatcg agtacgcgct cacgaaattt caccgcattc cgaacgtgtt catctacatg 720  
gacgccgccc actccggctg gcttgggtgg cccataatg ccagcggata cgtacaggaa 780  
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cagccgggtgg agtccggcgaatt tttctaccag tggaaatcctg acatcgacga agccgactac 960  
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accgatgtca acaccttcgtt caaccagtcg aagattgacc ttccggcagca ccgcggcctg 1140  
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ccgagcccga gcagctcgcc atcgccgtcg ccgtctccga gctcgagccc gtctccgtcg 1560  
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cagacctcggt ggaagattat ttccctacgtc ctgacccccc gtgcgacgtc gatcagtaat 3120  
ctggatttga aggcgatttt cgccggacgccc gcggcacgcg ggtcgctcaa cacctccgat 3180  
tacctgctcg acgttgaggc cgggttgag atctggcaag gtggtcaggg cctgggcagc 3240  
aactcggttca gcgtctccgt gacgagcggc acgtccagcc cgacaccgag cccgagcccg 3300  
acggccgacac cgagcccgac gccgacaccg tctccgagcc cgaccccgat gccgagtccg 3360  
accagctcgc cgtcgtcgat ggggtgtggcg tgccgggcga cgtatgtggt gaatagtgtat 3420  
tggggttctg ggttacggc gacggtgacg gtgacgaata cccggagccg ggcgacgaac 3480  
gggtggacgg tggcgtggtc gtttgggtggg aatcagacgg tcacgaacta ctggaacact 3540  
gcgttgcacc aatcagggtgc atcggtgacg ggcgacgaacc tgagttacaa caacgtgatc 3600  
caaccgggtc agtcgaccac cttcggattc aacggaagtt actcaggaac aaacgcccgcg 3660  
ccgacgctca gctgcacagc cagctga 3687

<210> 3  
<211> 53  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> potential signal peptide

<400> 3

Met Glu Arg Thr Gln Gln Ser Gly Arg Asn Cys Arg Tyr Gln Arg Gly  
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Thr Thr Arg Met Pro Ala Ile Ser Lys Arg Leu Arg Ala Gly Val Leu  
20 25 30

Ala Gly Ala Val Ser Ile Ala Ala Ser Ile Val Pro Leu Ala Met Gln  
35 40 45

His Pro Ala Ile Ala  
50

<210> 4  
<211> 423  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>

<221> misc\_feature

<223> Sequence of GH6 domain

<400> 4

Ala Thr His Val Asp Asn Pro Tyr Ala Gly Ala Thr Phe Phe Val Asn  
1 5 10 15

Pro Tyr Trp Ala Gln Glu Val Gln Ser Glu Ala Ala Asn Gln Thr Asn  
20 25 30

Ala Thr Leu Ala Ala Lys Met Arg Val Val Ser Thr Tyr Ser Thr Ala  
35 40 45

Val Trp Met Asp Arg Ile Ala Ala Ile Asn Gly Val Asn Gly Gly Pro  
50 55 60

Gly Leu Thr Thr Tyr Leu Asp Ala Ala Leu Ser Gln Gln Gln Gly Thr  
65 70 75 80

Thr Pro Glu Val Ile Glu Ile Val Ile Tyr Asp Leu Pro Gly Arg Asp  
85 90 95

Cys Ala Ala Leu Ala Ser Asn Gly Glu Leu Pro Ala Thr Ala Ala Gly  
100 105 110

Leu Gln Thr Tyr Glu Thr Gln Tyr Ile Asp Pro Ile Ala Ser Ile Leu  
115 120 125

Ser Asn Pro Lys Tyr Ser Ser Leu Arg Ile Val Thr Ile Ile Glu Pro  
130 135 140

Asp Ser Leu Pro Asn Ala Val Thr Asn Met Ser Ile Gln Ala Cys Ala  
145 150 155 160

Thr Ala Val Pro Tyr Tyr Glu Gln Gly Ile Glu Tyr Ala Leu Thr Lys  
165 170 175

Leu His Ala Ile Pro Asn Val Tyr Ile Tyr Met Asp Ala Ala His Ser  
180 185 190

Gly Trp Leu Gly Trp Pro Asn Asn Ala Ser Gly Tyr Val Gln Glu Val  
195 200 205

Gln Lys Val Leu Asn Ala Ser Ile Gly Val Asn Gly Ile Asp Gly Phe  
210 215 220

Val Thr Asn Thr Ala Asn Tyr Thr Pro Leu Lys Glu Pro Phe Met Thr  
225 230 235 240

Ala Thr Gln Gln Val Gly Gly Gln Pro Val Glu Ser Ala Asn Phe Tyr  
245 250 255

Gln Trp Asn Pro Asp Ile Asp Glu Ala Asp Tyr Ala Val Asp Leu Tyr  
260 265 270

Ser Arg Leu Val Ala Ala Gly Phe Pro Ser Ser Ile Gly Met Leu Ile  
275 280 285

Asp Thr Leu Arg Asn Gly Trp Gly Gly Pro Asn Glu Pro Thr Gly Pro  
290 295 300

Ser Thr Ala Thr Asp Val Asn Thr Phe Val Asn Gln Ser Lys Ile Asp  
305 310 315 320

Leu Arg Gln His Arg Gly Leu Trp Cys Asn Gln Asn Gly Ala Gly Leu  
325 330 335

Gly Gln Pro Pro Gln Ala Ser Pro Thr Asp Phe Pro Asn Ala His Leu  
340 345 350

Asp Ala Tyr Val Trp Ile Lys Pro Pro Gly Glu Ser Asp Gly Thr Ser  
355 360 365

Ala Ala Ser Asp Pro Thr Thr Gly Lys Lys Ser Asp Pro Met Cys Asp  
370 375 380

Pro Thr Tyr Thr Ser Tyr Gly Val Leu Thr Asn Ala Leu Pro Asn  
385 390 395 400

Ser Pro Ile Ala Gly Gln Trp Phe Pro Ala Gln Phe Asp Gln Leu Val  
405 410 415

Ala Asn Ala Arg Pro Ala Val  
420

<210> 5  
<211> 150  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> Sequence of CBD III domain

<400> 5

Val Ser Gly Gly Leu Lys Val Gln Tyr Lys Asn Asn Asp Ser Ala Pro  
1 5 10 15

Gly Asp Asn Gln Ile Lys Pro Gly Leu Gln Leu Val Asn Thr Gly Ser  
20 25 30

Ser Ser Val Asp Leu Ser Thr Val Thr Val Arg Tyr Trp Phe Thr Arg  
35 40 45

Asp Gly Gly Ser Ser Thr Leu Val Tyr Asn Cys Asp Trp Ala Ala Met  
50 55 60

Gly Cys Gly Asn Ile Arg Ala Ser Phe Gly Ser Val Asn Pro Ala Thr  
65 70 75 80

Pro Thr Ala Asp Thr Tyr Leu Gln Leu Ser Phe Thr Gly Gly Thr Leu  
85 90 95

Ala Ala Gly Gly Ser Thr Gly Glu Ile Gln Asn Arg Val Asn Lys Ser  
100 105 110

Asp Trp Ser Asn Phe Thr Glu Thr Asn Asp Tyr Ser Tyr Gly Thr Asn  
115 120 125

Thr Thr Phe Gln Asp Trp Thr Lys Val Thr Val Tyr Val Asn Gly Val  
130 135 140

Leu Val Trp Gly Thr Glu  
145 150

<210> 6  
<211> 85  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> FN III domain of GuxA

<400> 6

Asp Val Thr Pro Pro Ser Val Pro Thr Gly Leu Val Val Thr Gly Val  
1 5 10 15

Ser Gly Ser Ser Val Ser Leu Ala Trp Asn Ala Ser Thr Asp Asn Val  
20 25 30

Gly Val Ala His Tyr Asn Val Tyr Arg Asn Gly Val Leu Val Gly Gln  
35 40 45

Pro Thr Val Thr Ser Phe Thr Asp Thr Gly Leu Ala Ala Gly Thr Ala  
50 55 60

Tyr Thr Tyr Thr Val Ala Ala Val Asp Ala Ala Gly Asn Thr Ser Ala  
65 70 75 80

Pro Ser Thr Pro Val  
85

<210> 7  
<211> 231  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> GH12 domain of GuxA

<400> 7

Asp Cys Thr Pro Gly Pro Asn Gln Asn Gly Val Thr Ser Val Gln Gly  
1 5 10 15

Asp Glu Tyr Arg Val Gln Thr Asn Glu Trp Asn Ser Ser Ala Gln Gln  
20 25 30

Cys Leu Thr Ile Asn Thr Ala Thr Gly Ala Trp Thr Val Ser Thr Ala  
35 40 45

Asn Phe Ser Gly Gly Thr Gly Gly Ala Pro Ala Thr Tyr Pro Ser Ile  
50 55 60

Tyr Lys Gly Cys His Trp Gly Asn Cys Thr Thr Lys Asn Val Gly Met  
65 70 75 80

Pro Ile Gln Ile Ser Gln Ile Gly Ser Ala Val Thr Ser Trp Ser Thr  
85 90 95

Thr Gln Val Ser Ser Gly Ala Tyr Asp Val Ala Tyr Asp Ile Trp Thr  
100 105 110

Asn Ser Thr Pro Thr Thr Gly Gln Pro Asn Gly Thr Glu Ile Met  
115 120 125

Ile Trp Leu Asn Ser Arg Gly Gly Val Gln Pro Phe Gly Ser Gln Thr  
130 135 140

Ala Thr Gly Val Thr Val Ala Gly His Thr Trp Asn Val Trp Gln Gly  
145 150 155 160

Gln Gln Thr Ser Trp Lys Ile Ile Ser Tyr Val Leu Thr Pro Gly Ala  
165 170 175

Thr Ser Ile Ser Asn Leu Asp Leu Lys Ala Ile Phe Ala Asp Ala Ala  
180 185 190

Ala Arg Gly Ser Leu Asn Thr Ser Asp Tyr Leu Leu Asp Val Glu Ala  
195 200 205

Gly Phe Glu Ile Trp Gln Gly Gly Gln Gly Leu Gly Ser Asn Ser Phe  
210 215 220

Ser Val Ser Val Thr Ser Gly  
225 230

<210> 8  
<211> 101  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> Sequence of CBD II domain

<400> 8

Gly Val Ala Cys Arg Ala Thr Tyr Val Val Asn Ser Asp Trp Gly Ser  
1 5 10 15

Gly Phe Thr Ala Thr Val Thr Val Thr Asn Thr Gly Ser Arg Ala Thr  
20 25 30

Asn Gly Trp Thr Val Ala Trp Ser Phe Gly Gly Asn Gln Thr Val Thr  
35 40 45

Asn Tyr Trp Asn Thr Ala Leu Thr Gln Ser Gly Ala Ser Val Thr Ala  
50 55 60

Thr Asn Leu Ser Tyr Asn Asn Val Ile Gln Pro Gly Gln Ser Thr Thr  
65 70 75 80

Phe Gly Phe Asn Gly Ser Tyr Ser Gly Thr Asn Ala Ala Pro Thr Leu  
85 90 95

Ser Cys Thr Ala Ser  
100

<210> 9  
<211> 423  
<212> PRT  
<213> Acidothermus cellulolyticus

<220>  
<221> misc\_feature  
<223> GH6 domain of Acidothermus cellulolyticus

<400> 9

Ala Thr His Val Asp Asn Pro Tyr Ala Gly Ala Thr Phe Phe Val Asn  
1 5 10 15

Pro Tyr Trp Ala Gln Glu Val Gln Ser Glu Ala Ala Asn Gln Thr Asn  
20 25 30

Ala Thr Leu Ala Ala Lys Met Arg Val Val Ser Thr Tyr Ser Thr Ala  
35 40 45

Val Trp Met Asp Arg Ile Ala Ala Ile Asn Gly Val Asn Gly Gly Pro  
50 55 60

Gly Leu Thr Thr Tyr Leu Asp Ala Ala Leu Ser Gln Gln Gln Gly Thr  
65 70 75 80

Thr Pro Glu Val Ile Glu Ile Val Ile Tyr Asp Leu Pro Gly Arg Asp  
85 90 95

Cys Ala Ala Leu Ala Ser Asn Gly Glu Leu Pro Ala Thr Ala Ala Gly  
100 105 110

Leu Gln Thr Tyr Glu Thr Gln Tyr Ile Asp Pro Ile Ala Ser Ile Leu  
115 120 125

Ser Asn Pro Lys Tyr Ser Ser Leu Arg Ile Val Thr Ile Ile Glu Pro  
130 135 140

Asp Ser Leu Pro Asn Ala Val Thr Asn Met Ser Ile Gln Ala Cys Ala  
145 150 155 160

Thr Ala Val Pro Tyr Tyr Glu Gln Gly Ile Glu Tyr Ala Leu Thr Lys  
165 170 175

Leu His Ala Ile Pro Asn Val Tyr Ile Tyr Met Asp Ala Ala His Ser  
180 185 190

Gly Trp Leu Gly Trp Pro Asn Asn Ala Ser Gly Tyr Val Gln Glu Val  
195 200 205

Gln Lys Val Leu Asn Ala Ser Ile Gly Val Asn Gly Ile Asp Gly Phe  
210 215 220

Val Thr Asn Thr Ala Asn Tyr Thr Pro Leu Lys Glu Pro Phe Met Thr  
225 230 235 240

Ala Thr Gln Gln Val Gly Gly Gln Pro Val Glu Ser Ala Asn Phe Tyr  
245 250 255

Gln Trp Asn Pro Asp Ile Asp Glu Ala Asp Tyr Ala Val Asp Leu Tyr  
260 265 270

Ser Arg Leu Val Ala Ala Gly Phe Pro Ser Ser Ile Gly Met Leu Ile  
275 280 285

Asp Thr Leu Arg Asn Gly Trp Gly Gly Pro Asn Glu Pro Thr Gly Pro

290

295

300

Ser Thr Ala Thr Asp Val Asn Thr Phe Val Asn Gln Ser Lys Ile Asp  
305 310 315 320

Leu Arg Gln His Arg Gly Leu Trp Cys Asn Gln Asn Gly Ala Gly Leu  
325 330 335

Gly Gln Pro Pro Gln Ala Ser Pro Thr Asp Phe Pro Asn Ala His Leu  
340 345 350

Asp Ala Tyr Val Trp Ile Lys Pro Pro Gly Glu Ser Asp Gly Thr Ser  
355 360 365

Ala Ala Ser Asp Pro Thr Thr Gly Lys Lys Ser Asp Pro Met Cys Asp  
370 375 380

Pro Thr Tyr Thr Ser Tyr Gly Val Leu Thr Asn Ala Leu Pro Asn  
385 390 395 400

Ser Pro Ile Ala Gly Gln Trp Phe Pro Ala Gln Phe Asp Gln Leu Val  
405 410 415

Ala Asn Ala Arg Pro Ala Val  
420

<210> 10  
<211> 430  
<212> PRT  
<213> Cellulomonas fimi

<220>  
<221> misc\_feature  
<223> CBHA domain of Cellulomonas fimi

<400> 10

Ala Pro Val His Val Asp Asn Pro Tyr Ala Gly Ala Val Gln Tyr Val  
1 5 10 15

Asn Pro Thr Trp Ala Ala Ser Val Asn Ala Ala Ala Gly Arg Gln Ser  
20 25 30

Ala Asp Pro Ala Leu Ala Ala Lys Met Arg Thr Val Ala Gly Gln Pro  
35 40 45

Thr Ala Val Trp Met Asp Arg Ile Ser Ala Ile Thr Gly Asn Ala Asp  
50 55 60

Gly Asn Gly Leu Lys Phe His Leu Asp Asn Ala Val Ala Gln Gln Lys  
65 70 75 80

Ala Ala Gly Val Pro Leu Val Phe Asn Leu Val Ile Tyr Asp Leu Pro  
85 90 95

Gly Arg Asp Cys Phe Ala Leu Ala Ser Asn Gly Glu Leu Pro Ala Thr  
100 105 110

Asp Ala Gly Leu Ala Arg Tyr Lys Ser Glu Tyr Ile Asp Pro Ile Ala  
115 120 125

Asp Leu Leu Asp Asn Pro Glu Tyr Glu Ser Ile Arg Ile Ala Ala Thr  
130 135 140

Ile Glu Pro Asp Ser Leu Pro Asn Leu Thr Thr Asn Ile Ser Glu Pro  
145 150 155 160

Ala Cys Gln Gln Ala Ala Pro Tyr Tyr Arg Gln Gly Val Lys Tyr Ala  
165 170 175

Leu Asp Lys Leu His Ala Ile Pro Asn Val Tyr Asn Tyr Ile Asp Ile  
180 185 190

Gly His Ser Gly Trp Leu Gly Trp Asp Ser Asn Ala Gly Pro Ser Ala  
195 200 205

Thr Leu Phe Ala Glu Val Ala Lys Ser Thr Thr Ala Gly Phe Ala Ser  
210 215 220

Ile Asp Gly Phe Val Ser Asp Val Ala Asn Thr Thr Pro Leu Glu Glu  
225 230 235 240

Pro Leu Leu Ser Asp Ser Ser Leu Thr Ile Asn Asn Thr Pro Ile Arg  
245 250 255

Ser Ser Lys Phe Tyr Glu Trp Asn Phe Asp Phe Asp Glu Ile Asp Tyr  
260 265 270

Thr Ala His Met His Arg Leu Leu Val Ala Ala Gly Phe Pro Ser Ser  
275 280 285

Ile Gly Met Leu Val Asp Thr Ser Arg Asn Gly Trp Gly Gly Pro Asn  
290 295 300

Arg Pro Thr Ser Ile Thr Ala Ser Thr Asp Val Asn Ala Tyr Val Asp  
305 310 315 320

Ala Asn Arg Val Asp Arg Arg Val His Arg Gly Ala Trp Cys Asn Pro  
325 330 335

Leu Gly Ala Gly Ile Gly Arg Phe Pro Glu Ala Thr Pro Ser Gly Tyr  
340 345 350

Ala Ala Ser His Leu Asp Ala Phe Val Trp Ile Lys Pro Pro Gly Glu  
355 360 365

Ser Asp Gly Ala Ser Thr Asp Ile Pro Asn Asp Gln Gly Lys Arg Phe  
370 375 380

Asp Arg Met Cys Asp Pro Thr Phe Val Ser Pro Lys Leu Asn Asn Gln  
385 390 395 400

Leu Thr Gly Ala Thr Pro Asn Ala Pro Leu Ala Gly Gln Trp Phe Glu  
405 410 415

Glu Gln Phe Val Thr Leu Val Lys Asn Ala Tyr Pro Val Ile  
420 425 430

<210> 11  
<211> 432  
<212> PRT  
<213> Thermobifida fusca

<220>  
<221> misc\_feature  
<223> E3 domain of Thermobifida fusca

<400> 11

Pro Gly Gly Pro Thr Asn Pro Pro Thr Asn Pro Gly Glu Lys Val Asp  
1 5 10 15

Asn Pro Phe Glu Gly Ala Lys Leu Tyr Val Asn Pro Val Trp Ser Ala  
20 25 30

Lys Ala Ala Ala Glu Pro Gly Gly Ser Ala Val Ala Asn Glu Ser Thr  
35 40 45

Ala Val Trp Leu Asp Arg Ile Gly Ala Ile Glu Gly Asn Asp Ser Pro  
50 55 60

Thr Thr Gly Ser Met Gly Leu Arg Asp His Leu Glu Glu Ala Val Arg  
65 70 75 80

Gln Ser Gly Gly Asp Pro Leu Thr Ile Gln Val Val Ile Tyr Asn Leu  
85 90 95

Pro Gly Arg Asp Cys Ala Ala Leu Ala Ser Asn Gly Glu Leu Gly Pro  
100 105 110

Asp Glu Leu Asp Arg Tyr Lys Ser Glu Tyr Ile Asp Pro Ile Ala Asp  
115 120 125

Ile Met Trp Asp Phe Ala Asp Tyr Glu Asn Leu Arg Ile Val Ala Ile  
130 135 140

Ile Glu Ile Asp Ser Leu Pro Asn Leu Val Thr Asn Val Gly Gly Asn  
145 150 155 160

Gly Gly Thr Glu Leu Cys Ala Tyr Met Lys Gln Asn Gly Gly Tyr Val  
165 170 175

Asn Gly Val Gly Tyr Ala Leu Arg Lys Leu Gly Glu Ile Pro Asn Val  
180 185 190

Tyr Asn Tyr Ile Asp Ala Ala His His Gly Trp Ile Gly Trp Asp Ser  
195 200 205

Asn Phe Gly Pro Ser Val Asp Ile Phe Tyr Glu Ala Ala Asn Ala Ser  
210 215 220

Gly Ser Thr Val Asp Tyr Val His Gly Phe Ile Ser Asn Thr Ala Asn  
225 230 235 240

Tyr Ser Ala Thr Val Glu Pro Tyr Leu Asp Val Asn Gly Thr Val Asn

245

250

255

Gly Gln Leu Ile Arg Gln Ser Lys Trp Val Asp Trp Asn Gln Tyr Val  
260 265 270

Asp Glu Leu Ser Phe Val Gln Asp Leu Arg Gln Ala Leu Ile Ala Lys  
275 280 285

Gly Phe Arg Ser Asp Ile Gly Met Leu Ile Asp Thr Ser Arg Asn Gly  
290 295 300

Trp Gly Gly Pro Asn Arg Pro Thr Gly Pro Ser Ser Ser Thr Asp Leu  
305 310 315 320

Asn Thr Tyr Val Asp Glu Ser Arg Ile Asp Arg Arg Ile His Pro Gly  
325 330 335

Asn Trp Cys Asn Gln Ala Gly Ala Gly Leu Gly Glu Arg Pro Thr Val  
340 345 350

Asn Pro Ala Pro Gly Val Asp Ala Tyr Val Trp Val Lys Pro Pro Gly  
355 360 365

Glu Ser Asp Gly Ala Ser Glu Glu Ile Pro Asn Asp Glu Gly Lys Gly  
370 375 380

Phe Asp Arg Met Cys Asp Pro Thr Tyr Gln Gly Asn Ala Arg Asn Gly  
385 390 395 400

Asn Asn Pro Ser Gly Ala Leu Pro Asn Ala Pro Ile Ser Gly His Trp  
405 410 415

Phe Ser Ala Gln Phe Arg Glu Leu Leu Ala Asn Ala Tyr Pro Pro Leu  
420 425 430

<210> 12  
<211> 221  
<212> PRT  
<213> Streptomyces sp.

<220>  
<221> misc\_feature  
<223> Streptomyces sp. 11AG8 cellulase 12A

<400> 12

Asn Gln Gln Ile Cys Asp Arg Tyr Gly Thr Thr Thr Ile Gln Asp Arg  
1 5 10 15

Tyr Val Val Gln Asn Asn Arg Trp Gly Thr Ser Ala Thr Gln Cys Ile  
20 25 30

Asn Val Thr Gly Asn Gly Phe Glu Ile Thr Gln Ala Asp Gly Ser Val  
35 40 45

Pro Thr Asn Gly Ala Pro Lys Ser Tyr Pro Ser Val Tyr Asp Gly Cys  
50 55 60

His Tyr Gly Asn Cys Ala Pro Arg Thr Thr Leu Pro Met Arg Ile Ser  
65 70 75 80

Ser Ile Gly Ser Ala Pro Ser Ser Val Ser Tyr Arg Tyr Thr Gly Asn  
85 90 95

Gly Val Tyr Asn Ala Ala Tyr Asp Ile Trp Leu Asp Pro Thr Pro Arg  
100 105 110

Thr Asn Gly Val Asn Arg Thr Glu Ile Met Ile Trp Phe Asn Arg Val  
115 120 125

Gly Pro Val Gln Pro Ile Gly Ser Pro Val Gly Thr Ala His Val Gly  
130 135 140

Gly Arg Ser Trp Glu Val Trp Thr Gly Ser Asn Gly Ser Asn Asp Val  
145 150 155 160

Ile Ser Phe Leu Ala Pro Ser Ala Ile Ser Ser Trp Ser Phe Asp Val  
165 170 175

Lys Asp Phe Val Asp Gln Ala Val Ser His Gly Leu Ala Thr Pro Asp  
180 185 190

Trp Tyr Leu Thr Ser Ile Gln Ala Gly Phe Glu Pro Trp Glu Gly Gly  
195 200 205

Thr Gly Leu Ala Val Asn Ser Phe Ser Ser Ala Val Asn  
210 215 220

<210> 13  
<211> 221  
<212> PRT  
<213> Streptomyces lividans

<220>  
<221> misc\_feature  
<223> Streptomyces lividans cellulase B

<400> 13

Asp Thr Thr Ile Cys Glu Pro Phe Gly Thr Thr Thr Ile Gln Gly Arg  
1 5 10 15

Tyr Val Val Gln Asn Asn Arg Trp Gly Ser Thr Ala Pro Gln Cys Val  
20 25 30

Thr Ala Thr Asp Thr Gly Phe Arg Val Thr Gln Ala Asp Gly Ser Ala  
35 40 45

Pro Thr Asn Gly Ala Pro Lys Ser Tyr Pro Ser Val Phe Asn Gly Cys  
50 55 60

His Tyr Thr Asn Cys Ser Pro Gly Thr Asp Leu Pro Val Arg Leu Asp  
65 70 75 80

Thr Val Ser Ala Ala Pro Ser Ser Ile Ser Tyr Gly Phe Val Asp Gly  
85 90 95

Ala Val Tyr Asn Ala Ser Tyr Asp Ile Trp Leu Asp Pro Thr Ala Arg  
100 105 110

Thr Asp Gly Val Asn Gln Thr Glu Ile Met Ile Trp Phe Asn Arg Val  
115 120 125

Gly Pro Ile Gln Pro Ile Gly Ser Pro Val Gly Thr Ala Ser Val Gly  
130 135 140

Gly Arg Thr Trp Glu Val Trp Ser Gly Gly Asn Gly Ser Asn Asp Val  
145 150 155 160

Leu Ser Phe Val Ala Pro Ser Ala Ile Ser Gly Trp Ser Phe Asp Val  
165 170 175

Met Asp Phe Val Arg Ala Thr Val Ala Arg Gly Leu Ala Glu Asn Asp  
180 185 190

Trp Tyr Leu Thr Ser Val Gln Ala Gly Phe Glu Pro Trp Gln Asn Gly  
195 200 205

Ala Gly Leu Ala Val Asn Ser Phe Ser Ser Thr Val Glu  
210 215 220

<210> 14

<211> 228

<212> PRT

<213> Acidothermus cellulolyticus

<220>

<221> misc\_feature

<223> Acidothermus cellulolyticus GH12 domain

<400> 14

Cys Thr Pro Gly Pro Asn Gln Asn Gly Val Thr Ser Val Gln Gly Asp  
1 5 10 15

Glu Tyr Arg Val Gln Thr Asn Glu Trp Asn Ser Ser Ala Gln Gln Cys  
20 25 30

Leu Thr Ile Asn Thr Ala Thr Gly Ala Trp Thr Val Ser Thr Ala Asn  
35 40 45

Phe Ser Gly Gly Thr Gly Gly Ala Pro Ala Thr Tyr Pro Ser Ile Tyr  
50 55 60

Lys Gly Cys His Trp Gly Asn Cys Thr Thr Lys Asn Val Gly Met Pro  
65 70 75 80

Ile Gln Ile Ser Gln Ile Gly Ser Ala Val Thr Ser Trp Ser Thr Thr  
85 90 95

Gln Val Ser Ser Gly Ala Tyr Asp Val Ala Tyr Asp Ile Trp Thr Asn  
100 105 110

Ser Thr Pro Thr Thr Gly Gln Pro Asn Gly Thr Glu Ile Met Ile  
115 120 125

Trp Leu Asn Ser Arg Gly Gly Val Gln Pro Phe Gly Ser Gln Thr Ala

130

135

140

Thr Gly Val Thr Val Ala Gly His Thr Trp Asn Val Trp Gln Gly Gln  
145 150 155 160

Gln Thr Ser Trp Lys Ile Ile Ser Tyr Val Leu Thr Pro Gly Ala Thr  
165 170 175

Ser Ile Ser Asn Leu Asp Leu Lys Ala Ile Phe Ala Asp Ala Ala Ala  
180 185 190

Arg Gly Ser Leu Asn Thr Ser Asp Tyr Leu Leu Asp Val Glu Ala Gly  
195 200 205

Phe Glu Ile Trp Gln Gly Gly Gln Gly Leu Gly Ser Asn Ser Phe Ser  
210 215 220

Val Ser Val Thr  
225